DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

INTERNATIONAL OLYMPIAD ACADEMY

GRADE–11 & 12

FRANKLIN

ISO SCIENCE OLYMPIAD- 2023

Test Paper

Test Booklet Series

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Roll No.: | | | | | | | | | | | | | | | |

Student's Name:

Maximum Time: 90 Minutes **Maximum Marks: 120**

INSTRUCTIONS

1. Please **DO NOT OPEN** the contest booklet until the proctor has given permission to start.
2. There are 30 questions in this paper. **Easy:** 3 points for each correct answer. **Medium:**4 points for each correct answer. **Hard:** 5 points for eachcorrect answer. 1 point will be deducted for each incorrect answer, and no penalty for skipping a question.
3. There is only ONE correct answer to each question.
4. No electronic devices capable of storing and displaying visual information are allowed during the exam.
5. Use of **calculator** is strictly prohibited in the exam.
6. Fill your **Name, Roll No., Grade and School Name** in the answer sheet.
7. To mark your choice of answers by darkening the circles in the Answer Sheet, use an HB Pencil or a **Blue/Black Ball Point Pen** only.
8. Shade your answer clearly as per the example is shown below:

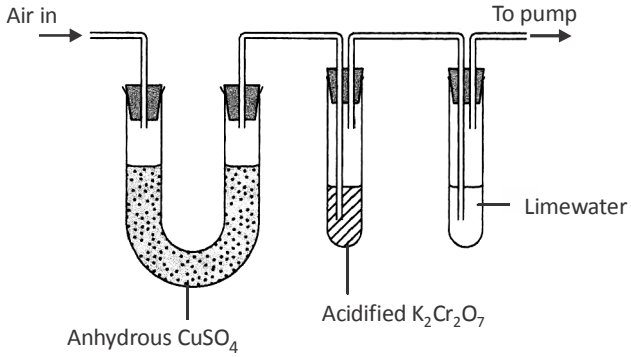
CORRECT	INCORRECT
(A) ● (C) (D)	(A) ⊗ ● (D)

SECTION – A (3 POINT PROBLEMS)

1. If a compound has resonance:
(A) The experimental value of its heat of formation decreases
(B) The experimental value of its heat of formation increases
(C) The stability of the compound decreases
(D) The stability of the compound remains unaffected

2. Evaporation of water is:
(A) A process in which neither heat is evolved nor absorbed
(B) A process accompanied by chemical reaction
(C) An exothermic change
(D) An endothermic change

3. The following setup was used to investigate the air around a school.

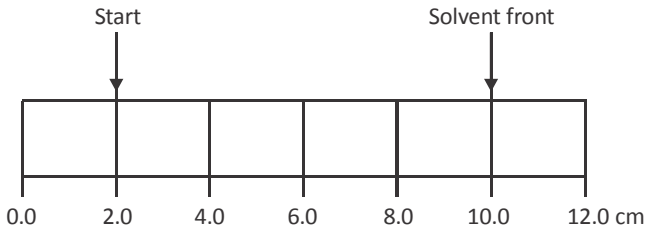


It was found that the copper (II) sulfate turned blue, the acidified potassium dichromate (VI) turned green and a white precipitate was formed in the limewater. What was present in the sample of air as indicated by the respective reagents?

	Anhydrous $CuSO_4$	**Acidified $K_2Cr_2O_7$**	**Limewater**
(A)	SO_2	SO_2	CO_2
(B)	O_2	SO_2	CO_2
(C)	H_2	CO_2	SO_2
(D)	H_2O	SO_2	CO_2

4. 250ml of the solution contains 7.35g of dibasic acid 25ml of this solution requires 15ml of N- NaOH solution for complete neutralization Equivalent and molecular weight of acid would be respectively -
(A) 49, 98 (B) 63, 126
(C) 32, 64 (D) 50, 100

5. A food dye is analyzed by paper chromatography, giving the chromatogram shown below:

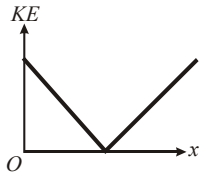


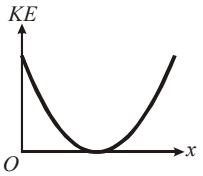
What is the R_f value of the dye represented by the spot at 8.0 cm?

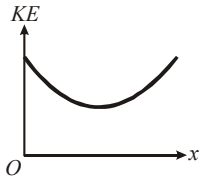
(A) 0.60 (B) 0.67

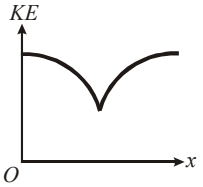
(C) 0.75 (D) 0.80

6. A ball is thrown up with a certain velocity at angle □ to the horizontal. The kinetic energy KE of the ball varies with horizontal displacement x as:

(A) 

(B) 

(C) 

(D) 

7. Titanium has five stable isotopes and shows three oxidation states +2, +3 and +4. Below is the particle formed from the most abundant isotope $_{22}Ti^{48}$

Which of the following shows the numbers of protons, neutrons and electrons of the particle formed by a different isotope of titanium?

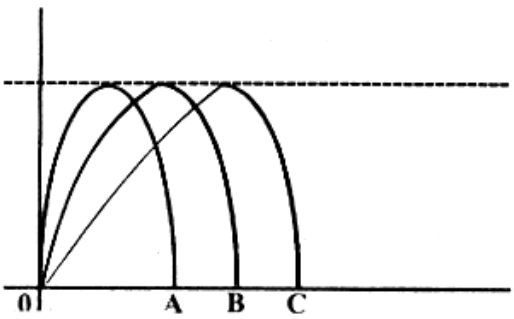
	Protons	Neutrons	Electrons
(A)	22	26	19
(B)	18	20	22
(C)	22	28	20
(D)	22	22	17

8. In the reaction, A + B $\rightleftharpoons$ C + D, the equilibrium constant K is determined by taking 1 mole of A and 1 mole of B as initial amounts. If 2 moles of A and 3 moles of B are taken, then the equilibrium constant will be

(A) Two times (B) Three times

(C) Six times (D) Unchanged

9. Three projectile A, Band C are thrown from the same point in the same plane. Their trajectories are shown in the figure. Then which of the following statement is true



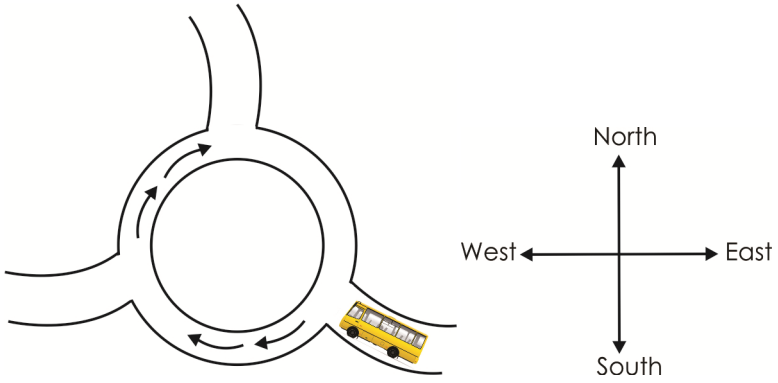
(A) The time of flight is the same for all the three

(B) The launch speed is greatest for particle C

(C) The horizontal velocity component is greatest for particle C

(D) All of the above

10. In given figure, a bus of mass 400 kg is travelling clock wisely. Around a flat roundabout (diameter 20 m) at a constant speed 10 m/s. Find the acceleration of the bus?



(A) 10 ms^{-2} East
(B) 10 ms^{-2} West
(C) 20 ms^{-2} East
(D) 5 ms^{-2} West

SECTION – B (4 POINT PROBLEMS)

11. Equal masses of SO_2, CH_4 and O_2 are mixed in empty container at 298 K, when total pressure is 2.1 atm. The partial pressures of CH_4 in the mixture is

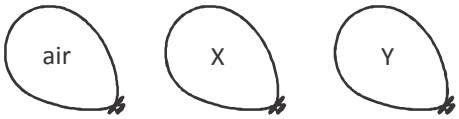
(A) 0.5 atm
(B) 0.75 atm
(C) 1.2 atm
(D) 0.6 atm.

12. A compound is formed by elements A and B. This crystallizes in the cubic structure when atoms A are the comers of the cube and atoms B are at the centre of the body. The simplest formula of the compounds is

(A) AB
(B) AB_2
(C) A_2B
(D) AB_4

13. Balloons are usually made of latex, which is a porous material that allows gas molecules to move in and out.

In one experiment, three balloons were filled with equal volumes of air, gas X and gas Y, and then left at room temperature for two days.

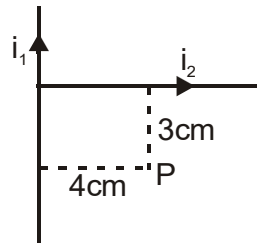


At the end of the experiment, the balloons containing air and gas X become smaller, while the balloon containing gas Y was found to be larger as shown:

Which of the following statements is true?

(A) Air diffuses at a faster rate than gas X
(B) Gas Y diffuses at a much slower rate than air
(C) Gas X has a higher molecular mass than gas Y
(D) Gas Y has the faster rate of diffusion compared to air and gas X

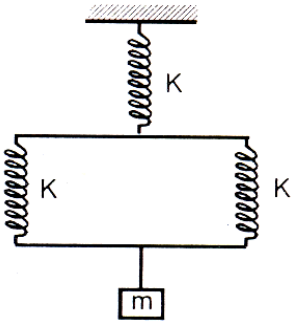
14. Two insulated wires of infinite length are lying mutually at right angles to each other as shown in. Currents of 2A and 1.5A respectively are flowing in them. The value of magnetic induction at point P will be



(A) 2×10^{-3}N/A-m (B) 2×10^{-5}N/A-m

(C) zero (D) 2×10^{-4}N/A-m

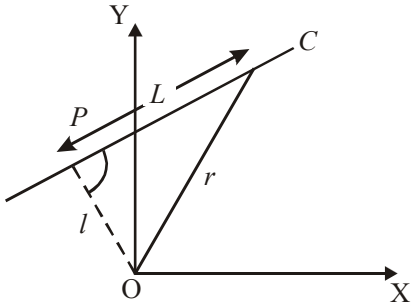
15. One body of mass m is suspended from three springs as shown in figure each spring has spring constant k. If mass m is displaced slightly then time period of oscillation is



(A) $2\pi\sqrt{\frac{m}{3k}}$ (B) $2\pi\sqrt{\frac{3m}{2k}}$

(C) $2\pi\sqrt{\frac{2m}{3k}}$ (D) $2\pi\sqrt{\frac{3k}{m}}$

16. A particle of mass *m* moves along line PC with velocity *v* as shown in figure. What is the angular momentum of the particle about P?



(A) mvl

(B) mvL

(C) zero

(D) mvr

17. Suppose the kinetic energy of a body oscillating with amplitude A and at a distance x is given by $K = \frac{Bx}{x^2 + A^2}$. The dimensions of B are the same as that of

(A) work/time

(B) work x distance

(C) work / distance

(D) work x time

18. Air can oxidize sodium sulphate in aq. solution but cannot do so in the case of sodium arsenite. If however, air is passed through a solution containing both sodium sulphite & sodium arsenite then both are oxidized. This is an example of

(A) Positive catalysis

(B) Negative catalysis

(C) Induced catalysis

(D) Auto catalysis

19. Which one of the following compounds will give in the presence of peroxide a product different from that obtained in the absence of peroxide?

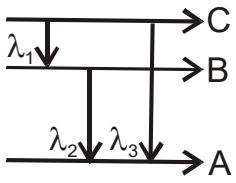
(A) 1-butane

(B) 1-butane, HBr

(C) 2-butene, HCl

(D) 2-butene, HBr

20. Energy levels A, B, C of a certain atom corresponds to increasing values of energy, i.e., $E_A < E_B < E_C$. If λ_1, λ_2 and λ_3 are the wavelengths of radiations corresponding to the transitions C to B, B to A and C to A respectively, which of the following statement is correct:



(A) $\lambda_3 = \lambda_1 + \lambda_2$

(B) $\lambda_3 = \dfrac{\lambda_1\lambda_2}{\lambda_1 + \lambda_2}$

(C) $\lambda_1 + \lambda_2 + \lambda_3 = 0$

(D) $\lambda^2_3 = \lambda^2_1 + \lambda^2_2$

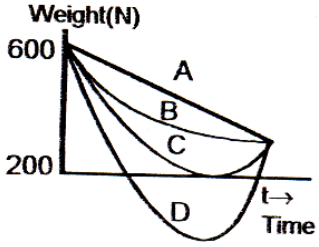
SECTION – C (5 POINT PROBLEMS)

21. The circulation of blood in human body supplies O_2 and releases CO_2. the concentration of O_2 and CO_2 is variable but, on an average, 100 ml blood contains 0.02 g of O_2 and 0.08 g of CO_2. The volume of O_2 and CO_2 at 1 atm and at body temperature 37°C, assuming 10 litres blood in human body, is

(A) 2 litrs, 4 litres (B) 1.5 litres, 4.5 litres

(C) 1.59 litres, 4.62 litres (D) 3.82 litres, 4.62 litres

22. Imagine the acceleration due to gravity on earth is 10m/s^2 and on mars is 4 m/s^2. A traveller of mass 60kg goes from earth to mars by a rocket movingwith constant velocity. If effect of other planets is assumed to be negligible, whichone of the following graphs shown the variation of weight of traveller with time



(A) A (B) B

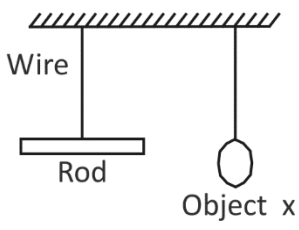
(C) C (D) D

23. An object of mass 2 kg is being dragged with a uniform velocity of 2 m/sec. on a rough horizontally plane. The coefficient of friction between the body and the surface is 0.20. The around of heat generated in 5sec. is (Give, J = 4.2 J/cal, g = 9.8 ms^{-2})

(A) 4.5 cal (B) 9.33 cal

(C) 18.15 cal (D) 35.18 cal

24. A thin rod whose length is 12.4 cm and whose mass is 135 g, suspended at its midpoint from a long wire as shown in figure. Its time period of angular SHM is measured to be 2.53 s. An irregularly shaped object X is then hung from the same wire as shown in figure and its time period is found to be 4.76 s. What is the rotational inertia of object *x* about its suspension axis?



(A) 6.12×10^{-4} kg m^2 (B) 12.6×10^{-4} kg m^2

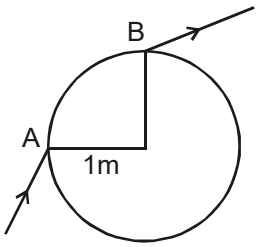
(C) 3.3×10^{-4} kg m^2 (D) 18.6×10^{-4} kg m^2

25. A body is approaching a thin convex lens of focal length 0.3 m with a speed of 0.01 m/s. When the object is of a distance of 0.4 m from the lens, then the magnitudes of the rates of change of position and lateral magnification of image are.

(A) 0.9 ms^{-1}, 0.3 s^{-1} (B) 0.3 ms^{-1}, 0.9 s^{-1}

(C) 0.09 ms^{-1}, 0.03 s^{-1} (D) 0.03 ms^{-1}, 0.9 s^{-1}

26. The wire used in the arrangement shown in figure has a resistance of r ohm permeter. The equivalent resistance between points A and B is



(A) $\left(\frac{6}{11}\right)r$ (B) $\frac{2\pi r}{(\pi+1)}$

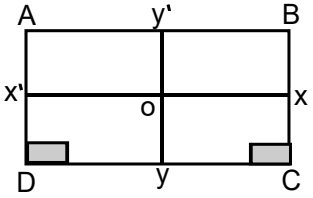
(C) $\frac{6\pi r}{(16+3\pi)}$ (D) $\frac{3\pi r}{(10+3\pi)}$

27. In a given process on an ideal gas, dW = 0 and dQ< 0. Then for the gas

(A) The temperature will decrease (B) The value will increase

(C) The pressure will remain constant (D) The temperature will increase

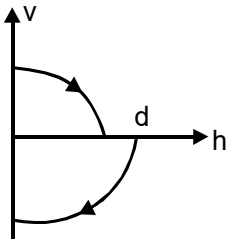
28. A uniform square plate ABCD has a mass of 10 kg. If two-point masses of 5kg each are placed at the corners C and D as shown in the adjoining figure, then the centre of mass shifts to the mid-point of

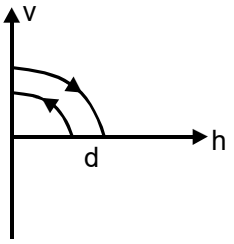


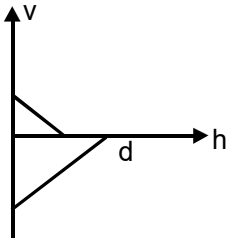
(A) OC (B) OD

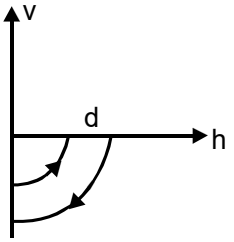
(C) OY (D) OX

29. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height d/2. Neglecting subsequent motion and air resistance, its velocity v varies with the height h above the ground as

(A)


(B)


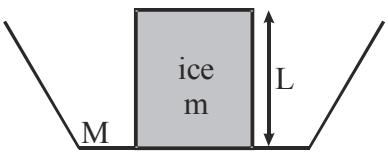
(C)


(D)


30. A cubical ice block of mass *m* and side *L* is placed in a large flat tray of mass *M*. When ice melts completely then how far does the centre of mass of (ice-tray) system shifts?

(A) does not shift (B) shifts $\frac{L}{2}$ downward

(C) shifts $\frac{\left(m\frac{L}{2}\right)}{M+m}$ (D) shifts $\frac{M\left(\frac{L}{2}\right)}{M+m}$



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